23. The method of claim 14, wherein the plasma is generated by delivering a power level of between about 10 watts and about 500 watts to the processing chamber.

24. (Amended) A method for processing a substrate in a processing chamber, comprising exposing a patterned substrate surface to a plasma generated from a gas mixture consisting of less than 75% by volume of argon and a mixture of about 95% by volume of helium and about 5% by volume of hydrogen.

25. The method of claim 24, wherein the plasma is capacitively and inductively powered.

26. (Amended) The method of claim 24, further comprising increasing the helium content to increase etching of the patterned substrate surface.

27. The method of claim 24, wherein the substrate surface comprises silicon oxide or silicon nitride.

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28. (Amended) The method of claim 24, wherein the gas mixture is introduced into the processing chamber to establish a pressure from about 1 mTorr to about 200 mTorr.

29. (Amended) The method of claim 24, wherein the gas mixture comprises between about 25% and about 75% by volume of argon.

30. The method of claim 24, wherein the plasma is generated by delivering a power level of between about 10 watts and about 500 watts to the processing chamber.

REMARKS

This is intended as a full and complete response to the Office Action dated February 5, 2001, having a shortened statutory period for response set to expire on May 5, 2001. Applicants acknowledge the Examiner's withdrawal of the Final Office Action dated December 4, 2000. Applicants have amended the claims to more accurately

recite the volume percentages of gas components in a gas mixture used to generate a plasma. Claims 1, 3-8, and 10-30 remain pending in the application and stand rejected.

Claims 1, 3, 5, 6, 7, 24, 25, and 27-30 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Konecni, et al.* (EP 0849 779 A2). The Examiner states that although *Konecni* does not specifically disclose the percent by volume of argon, it is well known that etching parameters, such as etchant concentration, temperature, and flow rate, affect both the rate and quality of the plasma etching process. The Examiner therefore asserts that it would have been obvious to adjust *Konecni's* etchant concentration by optimizing the same by conducting routine experimentation for the purpose of obtaining the best result.

Applicants respectfully traverse the rejection on grounds that the Examiner has not established a *prima facie* case of obviousness. To establish a *prima facie* case of obviousness, all claim limitations must be taught or suggested by the prior art. *See, In re Royka*, 490 F.2d 981, 180 USPQ 580 (CCPA 1974). Further, the teaching or suggestion to make the claimed invention and the reasonable expectation of success must both be found in the prior art, not in the applicants' disclosure. *See* M.P.E.P. § 2143, citing *In re Vaeck*, 947 F.2d 488 (Fed. Cir. 1991). *Konecni et al.* does not teach a plasma generated from a gas mixture consisting of argon, helium, and hydrogen, wherein the gas mixture comprises less than about 75% by volume of argon, as recited in claim 1 and those dependent therefrom. In fact, *Konecni et al.* teaches a plasma generated from a gas comprising 80% by volume of argon (a hydrogen flow rate of 1 sccm with an argon flow rate of 4 sccm). (*See, Konecni et al.* at col. 3, lines 55-59.) Therefore, all the claim limitations are not taught or suggested by *Konecni et al.* Accordingly, Applicants submit that the rejection was improper and respectfully request withdrawal of the rejection.

Further, the teaching or suggestion to make the claimed invention and the reasonable expectation of success is not found in *Konecni et al.* The claimed invention provides a method for processing a substrate in a processing chamber that surprisingly enhances the etch rate of the substrate by exposing the substrate to a plasma generated from a gas mixture consisting of argon, helium and hydrogen, wherein the gas mixture comprises less than about 75% by volume of argon. (*See,* specification at page 5, lines 24-31 and Figure 4.) As shown in Figure 4 of the application, the etch rate actually increases as the volume of argon decreases from 75% by volume to 25% by

volume. This correlation is contrary to expectation. One would have expected the etch rate to decrease as the volume of argon decreased. Therefore, Applicants submit that it would not have been obvious in light of *Konecni et al.* to arrive at the claimed invention. Accordingly, Applicants submit that the rejection was improper and respectfully request withdrawal of the rejection.

Claim 4 stands rejected under 35 U.S.C. §103(a) as being unpatentable over *Konecni, et al.* (EP 0849 779 A2) in view of *Jen* (U.S. Patent No. 5,773,367). The Examiner states that although *Konecni* does not specifically disclose the step of increasing the helium content of the plasma to increase etching of the patterned substrate surface, *Jen* discloses a method of plasma etching an oxide layer comprising the step of increasing the helium flow rate (content) to increase the etch rate of the patterned oxide surface. (*See,* col 6, lines 4-9 and Fig. 7A). The Examiner therefore asserts that it would have been obvious to modify *Konecni's* process by adding the step of increasing the flow rate (content) of helium to increase the etch rate of the patterned oxide surface as per *Jen* because *Konecni* states that bombardment of a material with inert ions (helium) increases the reactive surface area of the material accessible to reactive hydrogen ions. (*See,* col 7, lines 5-8).

Claims 8 and 10-23 also stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Konecni, et al.* in view of *Jen* for the same reasons stated above and because the Examiner asserts that it would have been obvious to modify *Konecni's* process by adding the step of increasing the flow rate (content) of helium to increase the etch rate of the patterned oxide surface as per *Jen* because *Konecni* states that bombardment of a material with inert ions (helium) increases the reactive surface area of the material accessible to reactive (etching) hydrogen ions (*See,* col 7, lines 5-8).

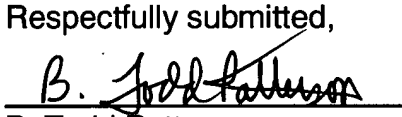
Applicants respectfully traverse the rejections on grounds that the combination of references does not expressly or impliedly teach, show, or suggest the claimed invention. *Konecni, et al.* has been distinguished above. *Jen* discloses a three step etching process wherein each step includes a varying amount of helium, freon, and oxygen. (*See, Jen* at col. 1, line 43 through col. 2, line 60.) *Jen* does not teach a plasma generated from a gas mixture consisting of argon, helium, and hydrogen, and contrary to the Examiner's assertion, Figure 7A shows a decrease in oxide etch rate as the flow rate of helium increases from 80 sccm to 100 sccm. Thus, *Jen* does not teach, show, or suggest increasing the helium content of a plasma generated from a gas

mixture consisting of argon, helium, and hydrogen to increase etching of the patterned substrate surface, as recited in claims 4, 8, and 14, as well as the claims dependent therefrom. Therefore, the references, when viewed in light of one another, do not motivate or suggest the claimed invention. Applicants respectfully request withdrawal of the rejection and allowance of the claims.

The prior art made of record is noted. However, it is believed that the secondary references are no more pertinent to the Applicants' disclosure than the primary references cited in the office action. Therefore, it is believed that a detailed discussion of the secondary references is not deemed necessary for a full and complete response to this office action. Accordingly, allowance of the claims is respectfully requested.

In conclusion, the references cited by the Examiner, neither alone nor in combination, teach, show, or suggest the claimed invention. Further, the claimed invention provides significant and unexpected etch rates as the helium content increases. Having addressed all issues set out in the office action, Applicants respectfully submit that the claims are in condition for allowance and respectfully request that the claims be allowed.

Respectfully submitted,



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APPENDIX

1. (Amended) A method for processing a substrate in a processing chamber, comprising exposing a patterned substrate surface to a plasma generated from a gas mixture consisting of argon, helium and hydrogen, wherein the [plasma] gas mixture comprises less than about 75% by volume of argon.

3. (Amended) The method of claim 1, wherein the hydrogen is provided to the processing chamber in a mixture of about 95% by volume of helium and about 5% by volume of hydrogen.

4. (Amended) The method of claim 1, further comprising increasing the helium content [of the plasma] to increase etching of the patterned substrate surface.

7. (Amended) The method of claim 1, wherein the gas mixture is [argon, helium and hydrogen are] introduced into the processing chamber to establish a pressure from about 1 mTorr to about 200 mTorr.

8. (Amended) A method for processing a substrate in a processing chamber, comprising:

(a) exposing a patterned substrate surface to a plasma generated from a gas mixture consisting of argon, helium and hydrogen; and

(b) increasing the helium content of the plasma to increase etching of the patterned substrate surface, wherein the [plasma] gas mixture comprises less than about 75% by volume of argon.

10. (Amended) The method of claim 8, wherein the hydrogen is provided to the processing chamber in a mixture of about 95% by volume of helium and about 5% by volume of hydrogen.

13. (Amended) The method of claim [1] 13, wherein the gas mixture is [argon, helium and hydrogen are] introduced into the processing chamber to establish a pressure from about 1 mTorr to about 200 mTorr.

14. (Amended) A method for processing a substrate, comprising:

(a) exposing a patterned substrate surface to a plasma generated from a gas mixture comprising argon, helium and hydrogen in a processing chamber, wherein the plasma is capacitively and inductively powered; and

(b) increasing the helium content [of the plasma] to increase etching of the patterned substrate surface, wherein the [plasma] gas mixture comprises less than about 75% by volume of argon.

15. (Amended) The method of claim 14, wherein the hydrogen is provided to the processing chamber in a mixture of about 95% by volume of helium and about 5% by volume of hydrogen.

17. (Amended) The method of claim 14, wherein the gas mixture is [argon, helium and hydrogen are] introduced into the processing chamber to establish a pressure from about 1 mTorr to about 200 mTorr.

18. (Amended) The method of claim 1, wherein the [plasma] gas mixture comprises between about 25% and about 75% by volume of argon.

19. (Amended) The method of claim 8, wherein the [plasma] gas mixture comprises between about 25% and about 75% by volume of argon.

20. (Amended) The method of claim 14, wherein the [plasma] gas mixture comprises between about 25% and about 75% by volume of argon.

24. (Amended) A method for processing a substrate in a processing chamber, comprising exposing a patterned substrate surface to a plasma generated from a gas mixture consisting of less than 75% by volume of argon and a mixture of about 95% by volume of helium and about 5% by volume of hydrogen.

26. (Amended) The method of claim 24, further comprising increasing the helium content [of the plasma] to increase etching of the patterned substrate surface.

28. (Amended) The method of claim 24, wherein the gas mixture is [argon, helium and hydrogen are] introduced into the processing chamber to establish a pressure from about 1 mTorr to about 200 mTorr.

29. (Amended) The method of claim 24, wherein the [plasma] gas mixture comprises between about 25% and about 75% by volume of argon.